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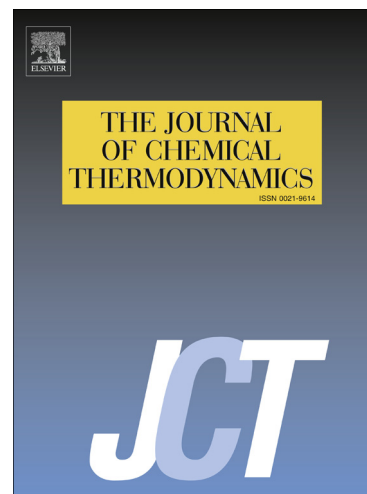
Thermodynamics of Hydrolysis of Cellulose to Glucose from 0 to 100°C: Cellulosic Biofuel Applications and Climate Change Implications

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Thermodynamics of Hydrolysis of Cellulose to Glucose from 0 to 100°C: Cellulosic Biofuel Applications and Climate Change Implications.

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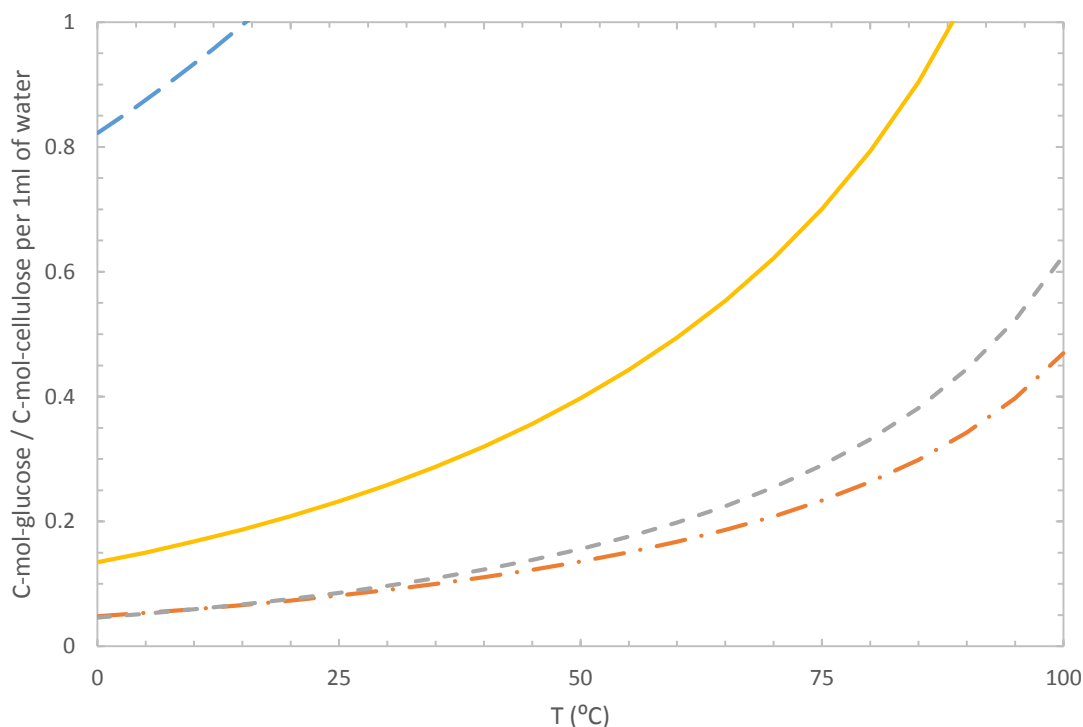
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Abstract

Hydrolysis of cellulose to glucose is a key reaction in renewable energy from biomass and in mineralization of soil organic matter to CO₂. Conditional thermodynamic parameters, $\Delta_{\text{hyd}}G'$, $\Delta_{\text{hyd}}H'$, and $\Delta_{\text{hyd}}S'$, and equilibrium glucose concentrations are reported for the reaction $C_6H_{10}O_5(\text{cellulose}) + H_2O(l) \rightleftharpoons C_6H_{12}O_6(aq)$ as functions of temperature from 0 to 100°C. Activity coefficients of aqueous glucose solution were determined as a function of temperature. The reaction free energy $\Delta_{\text{hyd}}G'$ becomes more negative as temperature increases, suggesting that producing cellulosic biofuels at higher temperatures will result in higher conversion. Also, cellulose is a major source of carbon in soil and is degraded by soil microorganisms into CO₂ and H₂O. Therefore, global warming will make this reaction more rapid, leading to more CO₂ and accelerated global warming by a positive feedback.

Key Words: Renewable energy; Biomass; Soil organic matter; Lignocellulose; Global warming; Glucose activity coefficient.

Graphical abstract:



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